PROCESSORS & GROWERS RESEARCH ORGANISATION

1991

GREEN BEAN TRIALS

1991

BROAD BEAN TRIAL

1991

FIELD BEAN TRIALS

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THE SEASON

The weather experienced in the 1991 season would in the past have been described as "atypical of normal weather conditions usually experienced in the pea and bean growing areas". It has been "atypical" for the last three seasons, perhaps these are becoming the normal conditions to expect.

It was generally a mild winter, but frost during a few days in early February weathered the soil so it was possible to achieve satisfactory seedbeds after pre-drilling cultivations. Temperatures in March and April were average for the time of year. Rainfall in March was 15 mm below the long term average, and average in April, but it was only 38% of the long term average in May. June rainfall was 10 mm higher than average and this resulted in vigorous field and broad bean growth. Temperatures were about 3°C lower than normal and this cool spell adversely affected green beans. July and August were both hot and dry months with maximum temperatures in excess of 25°C. Only 32% of the expected rainfall fell in July and just 20% in August.

Fungal diseases caused some problems in the wetter areas this season after rain in June and July. Some field and broad bean crops were infected with downy mildew *(Peronospora viciae)* and occasionally chocolate spot *(Botrytis fabae)*. In many areas aphid infestations occurred late, after flowering and pod set. Growth of field beans was more vigorous than the previous season and some crops suffered from lodging. Harvest was later than in 1989 and 1990 and carried out under mainly dry conditions. In the hot weather in August broad bean crops matured rapidly.

Green beans suffered few disease problems this season and little wind scar damage, but the hot dry conditions adversely affected pod quality.

METEREOLOGICAL DATA

Month	1991 Average Temperature		Long Term Average Temperature	
	Maximum °C	Minimum °C	Maximum °C	Minimum °C
February	4.6	-0.44	6.1	0.9
March	11.2	5.1	9.0	1.9
April	11.6	4.1	11.9	4.0
May	14.1	7.3	15.7	6.5
June	15.8	8.8	19.1	9.5
July	22.4	12.9	20.6	11.1
August	23.0	12.4	20.4	11.4
September	19.7	10.1	18.1	9.7

Month	1991 Monthly Rainfall (mm)	Long Term Average Rainfall (mm)
February	39.4	39.2
March	29.4	44.1
April	45.0	42.3
May	17.4	46.2
June	17.0	49.7
July	16.8	52.5
August	12.6	63.5
September	53.6	46.2

Source 1991 data - PGRO; Long Term Average - Metereological Office

GREEN BEANS

SUMMARY - MAIN TRIAL VARIETIES TESTED 1989-1991

Weather conditions were dry over the three seasons. In 1989 the weather after sowing was dry, sunny and warm but drought stress was prevented by occasional rain storms. In 1990 apart from a cooler period during the second week in June and the first week in July, temperatures were very high, the weather was exceptionally dry and yields were poor. Yields were higher in 1991, although May rainfall was low, only 38% of the long term average, June rainfall was a little higher than average but temperatures were lower than average and green bean growth was retarded during this time although July and August were very dry and hot. In all three seasons beans matured rapidly, so varietal differences in maturity were probably less than in a more "normal" season.

The yield standard Groffy did not perform well in the drought conditions of 1989 and 1990, but was more tolerant of the initially cool start of the 1991 season. Nerina seemed more tolerant of drought stress.

Flevoro yielded similarly to the standard Lasso and matured one day earlier. Pods were darker, and slightly narrower than Lasso and pods did not become over mature rapidly. The quick-frozen sample was excellent. Flevoro had a high percentage of "T" stalks in the machine harvested sample and was similar to Lasso in this respect.

Maxima (RO 34) yielded similarly to Groffy and at freezing stage was of similar maturity. Plant habit was tall and vigorous even under dry conditions. Pods were of medium colour (darker than Groffy) and were not as wide and therefore more suitable for cutting than slicing.

Machine harvesting characteristics were variable, with few "T" stalks in 1989 and 1990 but a high proportion in 1991.

Novores is a late maturing variety, which yielded a little lower than Groffy but differences were not statistically significant. Pods were darker and slimmer than Groffy and the quick-frozen sample had an attractive appearance. This variety had excellent machine harvesting characteristics and with a very low percentage of "T" stalks in the three harvest years.

TRIALS IN 1991

Varieties with a wide range of pod types were evaluated, including flat podded beans (standard Roma II), several intermediate podded beans for quick-freezing whole (standard Nerina) or for cutting and slicing (standard Groffy). There were only two short podded beans in trials (standard Lasso), but despite lack of interest from the Industry so far, six very fine/extra fine beans were entered and compared with Masai. In all trials yield and maturity are relative to Groffy. A key to variety source is given in Appendix I.

All seed was treated with an insecticidal/fungicidal seed treatment to control bean seed fly *(Delia platura)* and fungal "damping-off" disease.

The Main Variety Trial was sown on 10th June, and the Preliminary and Screening Trials were sown later on the 20th June, into a moist fine seedbed. The weather after sowing was warm, rainfall in June was above average, and the green beans emerged quickly and evenly.

There was a large soil moisture deficit however and July and August were very dry months. As in 1990, plants and pods were short. There was no *Botrytis* infection, and no wind scar damage. However pod quality was

affected by hot, dry conditions and most varieties suffered from string and parchment in pods.

Harvest began on 19th August and ended on 2nd September.

Preliminary Trial and quick-freezing stage of Main Trial were harvested with the Ploeger transverse machine plot harvester. Results for the percentage of "T" stalks in the sample, a varietal characteristic are presented. Initial trials with the machine showed that assessments for damaged and broken beans are more dependent on machine operation than variety.

Main Trial green bean varieties and additional ones from several seed companies were demonstrated at a site near Aylsham, Norfolk on 22nd August.

MAIN TRIAL, THORNHAUGH - 1991

Yields were better than in the previous season. Flevoro, Maxima (RO 34) and Novores were in their final year of evaluation.

Nassau a new flat podded variety was compared with *Roma II (Kingreen)*. Neither yielded well this season, possibly an effect of uneven maturity. Nassau had longer, narrower pods than Roma II and pod colour was not as pale but pods were more curly. Both gave attractive products. Plants were short and most pods touched the soil. Percentage of "T" stalks in the harvested sample were similar to Roma II.

Flevoro a new short podded fine bean, yielded similarly to Lasso the standard. Pods were dark, smooth and straight and pod width less than 8 mm (narrower than Lasso), and appearance was outstanding. Pods held their colour and maturity well. Plant habit is taller than Lasso, and few pods touched the soil. Machine harvesting characteristics were similar to Lasso with a high percentage of "T" stalks in the sample this year.

Lasso the standard short podded bean yielded significantly lower than Groffy. Pods were medium colour and pod width less than 8 mm.

Nerina the intermediate fine podded standard, harvested early for quick-freezing as a whole podded bean, yielded less than Groffy at this stage, but yields were similar at canning stage. There were no other beans of this type in trial.

Groffy, the intermediate podded standard for cutting and slicing, performed better than in 1990, and was tolerant of the cool conditions in June. Machine harvesting characteristics were excellent.

There were four other varieties of this type in trial, pod width was generally less than Groffy and hence less suitable for slicing:-

Maxima (RO 34) was of similar maturity and yield to Groffy. Pods were medium/dark colour but not as wide as Groffy and more suitable for cutting than slicing. Pods were not as straight as Groffy. Plant habit was tall and vigorous and this variety also seemed to tolerate the initially cool conditions. There was a high percentage of "T" stalks in the machine harvested produce, and harvestability was poor compared with results in 1990.

Ventura (HS 200) yielded less than other varieties of this type but not significantly so. Pod colour was medium (darker than Groffy), and pods were longer but the width less than Groffy. Ventura had a good plant habit and harvestability.

Novores was late maturing. Pods were dark and slimmer than Groffy and gave an excellent even quick-frozen sample. Yields were good, and similar to Groffy. Plants are tall and vigorous, but pods were set low on the plant and several touched the soil. This variety had the lowest percentage of "T" stalks in the harvested sample.

Modus a long podded variety, matured one day after Groffy and gave similar yields. Pods were darker in colour (medium/dark) but not as straight, and slimmer so more suitable for cutting. There was a higher percentage of "T" stalks in the sample than Groffy.

PRELIMINARY TRIAL, THORNHAUGH - 1991

Varieties entered in Preliminary Trial are on, or entered for National List in an EEC Member country.

There was only one new short podded fine bean in trial:-

Boreal for processing whole, was late maturing. Pods were similar length and colour to Lasso but narrower. Maturity was uneven and produce less uniform in size than Lasso. Yields were much higher than Lasso and similar to Groffy. Plants were vigorous but pods were held at the top of the plant. Machine harvestability was very poor, several plants were pulled out of the ground, and produce had the highest percentage of "T" stalks.

Lasso the short podded standard, gave yields consistent with previous years and an attractive sample of produce.

Three very fine/extra fine green beans were compared with Masai, and all gave excellent yields for varieties of this type.

Masai a very fine bean gave excellent yields. Pods were medium colour, straight and less than 7 mm wide at quick-freezing stage. Plant habit was erect, no pods touched the soil. Machine harvestability was very good with few "T" stalks in the sample.

Label was a very fine/extra fine bean. Pod width was less than Masai, and pods were longer but rather curly. Produce was a very dark colour. It matured more rapidly than Masai. Plant habit was vigorous and erect but the percentage of "T" stalks in the machine harvested sample was significantly greater than Masai.

Niki extra fine podded, gave pods less than 6.5 mm wide which were even in size and straight. Seeds were rather large. The plants were erect, pods held near the top of the plant but there was a high percentage of "T" stalks in the produce. This variety showed visible symptoms of wilting under drought stress.

Larissa a very fine podded variety had wider pods than Niki or Label. Raw pod colour was medium but colour became darker after processing. Yields and harvestability were excellent with a low percentage of "T" stalks.

Four varieties were compared with Nerina:-

Nerina, the standard intermediate podded variety for quick-freezing as a whole bean, was the highest yielding variety in trial, but machine harvesting characteristics were poor.

Monica matured 3 days earlier than Nerina. Pods were very short and shorter than Nerina. Seeds were large and although not prominent, developed rapidly. Yields were significantly lower than Nerina, and harvestability was no better. Plant habit was good.

Cantare pods were not as wide or long as Nerina, and also paler but straight. Yields were not as high as Nerina. Seeds were large but not prominent. Plant habit was good but there was a high percentage of "T" stalks in the machine harvested produce.

Sirio pods were also shorter than Nerina, but a similar width and colour. Seeds of this variety were also large. Yields were good but not as high as Nerina, and harvestability was superior. Plants were tall and vigorous.

HS 537 was late maturing. Pods were straight, dark green and less than 9 mm width. Maturity was uneven and hence the produce was not very uniform in size. Yields were high and similar to Nerina. Plants were tall and vigorous with beans well distributed on the plant.

Two varieties were compared with Groffy:-

Groffy the standard for cutting and slicing, performed better than in 1990, but in this trial several varieties gave higher yields, although with the exception of Nerina, these were not statistically significant. Pods were straight and the machine harvested sample had the lowest percentage of "T" stalks in trial at both canning and freezing stages.

RS 1368 matured very early, 5 days before Groffy. Pods were not as wide, and were more suitable for cutting than slicing. Although pod colour was better, the pods were not very straight. Yields were very low. Plants were short with several beans touching the soil and this variety was difficult to harvest.

Fesca (NUN 7324) is a long podded variety for cutting and slicing, similar to Modus, but pods were short this season. Pods were medium/dark colour but not as straight as Groffy. Yields were better than Groffy but differences were not significant. Plants were tall and vigorous and harvestability was good.

The most promising varieties in trial were HS 537, and also Larissa and Niki which gave most attractive samples of produce. Varieties selected for main trial for 1992 were HS 537, Larissa (and PV 496 from 1990 trials).

SCREENING TRIAL, THORNHAUGH - 1991

Varieties of several pod types were entered in this trial. Since pods were shorter than usual, varieties are classified according to information from the breeder.

Lasso the standard, was the only short podded bean in trial. Yields were average for a bean of this type and pods were 8 mm width, straight and medium colour.

Three extra fine/very fine podded varieties were evaluated:

WAV 4000 was suitable for processing as a whole bean. Pods were uniform and less than 7 mm wide, but rather curly and medium pale colour. Seeds of all three varieties were small. Plants were short although pods were well distributed on the plant.

WAV 965 plants were also short and pods clustered in the centre. Pods had a very uniform width of less than 7 mm.

WAV 6000 pods were longer, rather curly and width was less uniform. Pod colour was medium/dark and flavour was good. Pods were finer than the other two varieties. Plants were vigorous and erect, but pods were

clustered in the centre of the plant. It was the highest yielding variety of this group.

Three intermediate podded "whole bean" varieties were compared with Nerina:-

Nerina harvested early for quick-freezing whole yielded less than Groffy, but yields were similar at canning stage.

MIV 15 was early maturing. Pods were rather curly, not as dark as Nerina. Pods were wider and more suitable for cutting. Plants were short and pods touched the soil. Yields were lower than Nerina.

NAB pods also appeared more suitable for cutting. Pods were shorter, straight and slightly darker than Nerina. Although seeds were not prominent they were large. Plants were vigorous and pods held well off the ground. Yields were similar to Nerina.

NIZ 029 pods were of similar colour and shorter and slimmer than Nerina. Pod maturity was rather uneven. Plants were very short and several pods touched the soil. Yields were similar to Nerina.

Three varieties suitable for cutting and slicing were compared with Groffy:-

Groffy yielded well in this trial and all other varieties gave lower or similar yields. Pods were intermediate length, straight and medium/pale colour.

PV 528 matured before Groffy. Pods were similar size but darker green colour although not as straight. The quick-frozen sample was attractive. Yields were a little lower than the standard. Plant habit was not as good as Groffy and some pods touched the soil.

NIZ 028 pods were shorter and slimmer than Groffy. The straight pods were medium colour. Yields were similar to Groffy but plant habit was not as good.

WAV 9017 matured late, 5 days after Groffy. It was long podded but pod width was only 8-9 mm. Pods were medium/dark green colour and not as straight as Groffy, and the processed sample rather uneven in size. Yields were lower than Groffy at freezing stage and similar at canning stage. Plants were tall and erect but pods were clustered in the centre of the plant.

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Main Variety Trial Summary 1989 - 1991
Varieties placed in order of maturity within each group. Standard varieties underlined
Results are means of three replicates. Target population 45 plants/m^2. Row width 30 cm

Variety	Source	Seeds /kg	At Practical Freezing Stage: Maturity (± days) relative to Groffy	At Practical Freezing Stage: Yield % of Groffy	At Practical Canning Stage: Maturity (± days) relative to Groffy	At Practical Canning Stage: Yield % of Groffy	#Plant habit	No. of pods touching soil 1=most 5=none	Pod Characteristics: External colour raw	Shape 1=very curved 5=straight F	Pod length cm F	Pod length cm C	Section 1=flat 5=round F	Pod width mm F	Pod width mm C
Short															
Lasso	PV	6428	0	67¯	- 1	64¯	5.0	3.8	M	4.3	9.2	9.6	3.9	7.8	8.2
Flevoro$	PV	5700	- 1	64¯	- 1	63¯	5.0	4.5	M/D	4.5	9.8	10.0	3.9	7.3	8.2
Intermediate (whole)															
Nerina	RS	5076	0	82	- 1	91	4.8	4.5	M	4.3	11.5	12.0	4.2	8.4	8.8
Intermediate															
Groffy	Nun	3877	0	100 (7.6t/ha)	0	100 (8.6t/ha)	5.0	4.5	P	4.7	12.0	12.4	4.7	10.5	10.9
Maxima (RO34)	S&G	4299	0	95	- 1	98	4.7	4.0	M	4.4	12.4	12.8	4.6	9.2	9.5
Novores	PV	4799	+ 5	93	+ 4	84	4.7	4.0	M/D	4.0	11.1	11.6	4.3	9.7	10.1
Significance @ P = 0.05				SD		SD									
LSD @ P = 0.05				24.74		18.16									
CV %				15.7		11.1									

#Plant habit 5 = vigorous/erect/good pod distribution; 1 = short/lax/pods tangled/above leaf canopy
P = Pale; M = Medium; D = Dark. ¯ Significantly less than Groffy @ P = 0.05
$ only tested 1990 & 1991
Short pods (10 cm or less) suitable for freezing or canning whole; freezing stage SL (seed length) 80; canning SL 90
Intermediate pods (10 - 13 cm length; < 9.5 mm width) for freezing whole or cutting; freezing stage SL 90; canning SL 110
Intermediate pods (10 - 13 cm length) suitable for cutting (or slicing); freezing stage SL 90; canning SL 110

7/1991

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Main Variety Trial 1991
Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 10th June
Results are means of three replicates. Target population 45 plants per m^2. Row width 25 cm

Variety	Source	Seeds /kg	At Practical Freezing Stage: Maturity (± days) relative to Groffy	At Practical Freezing Stage: Yield % of Groffy	At Practical Canning Stage: Maturity (± days) relative to Groffy	At Practical Canning Stage: Yield % of Groffy	#Plant habit	No. pods touching soil 1=most 5=none	Pod Characteristics: External colour raw	Shape 1=v.curved 5=straight F	Shape C	Average length cm F	Average length cm C	Section 1=flat 5=round F	Section C	Pod width mm F	Pod width mm C
Flat																	
Nassau	HS	2470	0	77⁻	- 1	78⁻	4	1	M/P	4.0	3.6	15.2	15.8	1.0	1.0	13.8	14.7
Roma II	Rog	2280	+ 1	87	0	77⁻	5	3	P	4.5	4.3	12.4	13.0	1.0	1.0	17.0	17.1
Short																	
Flevoro	PV	5592	- 1	62⁻	- 1	66⁻	5	4	D	4.7	4.6	10.0	9.9	3.8	4.1	7.2	8.1
Lasso	PV	6508	0	64⁻	- 1	67⁻	5	3.5	M	4.5	4.7	9.3	9.9	4.0	4.3	7.8	8.1
Intermediate (whole)																	
Nerina	RS	5963	0	79	- 1	95	4.5	4	M	4.5	4.2	12.4	12.5	4.3	4.4	8.3	8.9
Intermediate																	
Groffy	Nun	3992	0 (20/8)	100 (10t/ha)	0 (23/8)	100 (11t/ha)	5	4	P	4.7	4.8	11.8	12.2	4.9	5.0	10.7	10.7
Maxima (RO 34)	S&G	4397	0	90	- 1	96	5	5	M/D	4.4	4.4	11.8	12.4	4.7	4.7	9.3	9.3
Ventura (HS 200)	HS	2823	+ 1	79	0	82	5	4	M	4.5	4.6	13.0	13.4	4.7	4.9	10.2	10.4
Novores	PV	5149	+ 5	103	+ 4	97	5	3	D	3.8	3.7	10.6	11.2	4.6	4.6	9.9	10.1
Long																	
Modus	Nun	3630	+ 1	95	0	104	5	3	M/D	3.6	3.4	13.8	14.2	4.7	4.7	9.8	10.1
Significance @ P = 0.05				SD		SD						SD	SD			SD	SD
LSD @ P = 0.05				21.6		21.5						0.62	1.48			0.70	1.09
CV %				15.0		14.5						3.0	6.9			4.9	5.9

#Plant habit 5 = vigorous/erect/good pod distribution; 1 = short/lax/pods tangled/above leaf canopy
P = Pale; M = Medium; D = Dark. ⁻ Significantly less than Groffy @ P = 0.05
Short pods (10 cm or less) suitable for freezing or canning whole; freezing stage SL (seed length) 80; canning SL 90
Intermediate pods (10 - 13 cm length; < 9.5 mm width) for freezing whole or cutting; freezing stage SL90; canning SL 110
Intermediate pods (10 - 13 cm length) suitable for cutting (or slicing); freezing stage SL 90; canning SL 110
Long pods (> 13 cm length) suitable for cutting or slicing; freezing stage SL 100; canning SL 120

8/1991

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Preliminary Variety Trial 1991
Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 20th June
Results are means of two replicates. Target population 45 plants per m^2. Row width 25 cm

Variety	Source	Seeds /kg	At Practical Freezing Stage: Maturity (± days) relative to Groffy	At Practical Freezing Stage: Yield % of Groffy	At Practical Canning Stage: Maturity (± days) relative to Groffy	At Practical Canning Stage: Yield % of Groffy	#Plant habit	No. pods touching soil 1=most 5=none	Pod Characteristics: External colour raw	Shape 1=v.curved 5=straight F	Shape C	Average length cm F	Average length cm C	Section 1=flat 5=round F	Section C	Pod width mm F	Pod width mm C
Short																	
Lasso	PV	6509	0	70-	0	81-	5	5	M	4.8	4.8	8.9	9.0	4.6	4.9	7.9	8.1
Boreal	N&S	6752	+ 4	105	+ 2	95	4.5	5	M	4.6	4.5	8.9	9.0	4.4	4.6	7.5	8.2
Intermediate (very fine/extra fine)																	
Masai	S&G	6922	0	106	0	105	5	5	M/D	4.6	4.5	8.9	9.2	4.0	4.6	6.8	7.3
Label	Vil	6489	+ 1	92	0	97	5	5	M	4.1	4.0	10.8	10.8	4.6	5.0	6.6	6.8
Niki	RS	5963	+ 2	91	+ 2	81-	5	5	M/P	4.6	4.4	10.3	10.3	4.2	4.2	6.0	6.4
Larissa	PV	5845	+ 4	116	+ 4	105	5	5	M	4.5	4.3	9.5	9.4	4.3	4.4	7.0	7.0
Intermediate (whole)																	
Monica	HS	4991	- 3	88	- 5	87	5	5	M	4.8	4.8	10.1	10.2	4.2	4.2	8.4	8.4
Cantare	PV	5702	- 1	100	- 3	100	5	5	M	4.6	4.3	9.9	10.4	4.5	4.9	8.0	8.2
Sirio	S&G	4247	0	105	- 1	97	5	5	M	4.8	4.4	9.9	10.5	4.6	4.8	8.6	8.9
Nerina	RS	5453	0	121+	0	117+	4.5	4.8	M	4.4	4.3	11.0	11.2	4.6	4.9	8.6	9.4
HS 537	HS	4583	+ 4	114	+ 3	103	5	5	D	4.4	4.6	11.0	11.5	4.8	4.8	8.3	9.0
Intermediate																	
RS 1368	RS	3737	- 5	46-	- 7	75-	4	2	M	4.2	4.2	12.2	12.4	4.2	4.7	8.4	9.2
Groffy	Nun	3992	0 (22/8)	100 (6.1t/ha)	0 (27/8)	100 (7.0t/ha)	5	5	M/P	4.8	4.8	11.5	12.0	4.8	5.0	10.8	10.5

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(continued) GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Preliminary Variety Trial 1991
Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 20th June
Results are means of two replicates. Target population 45 plants per m^2. Row width 25 cm

Variety	Source	Seeds /kg	At Practical Freezing Stage: Maturity (± days) relative to Groffy	At Practical Freezing Stage: Yield % of Groffy	At Practical Canning Stage: Maturity (± days) relative to Groffy	At Practical Canning Stage: Yield % of Groffy	#Plant habit	No. pods touching soil 1=most 5=none	Pod Characteristics: External colour raw	Shape 1=v.curved 5=straight F	Shape 1=v.curved 5=straight C	Average length cm F	Average length cm C	Section 1=flat 5=round F	Section 1=flat 5=round C	Pod width mm F	Pod width mm C
Long																	
Fesca (NUN 7324)	Nun	5113	+ 1	111	+ 2	110	5	4.5	M/D	4.1	4.3	12.4	12.0	4.6	4.8	9.4	9.9
Significance @ P = 0.05				SD		SD						SD	SD			SD	SD
LSD @ P = 0.05				20.0		13.07						0.76	0.88			0.67	0.49
CV %				9.5		6.3						3.4	3.9			3.9	2.7

# Plant habit 5 = vigorous/erect/good pod distribution; 1 = short/lax/pods tangled/above leaf canopy
P = Pale; M = Medium; D = Dark. + Significantly greater than Groffy @ P = 0.05; - Significantly less than Groffy @ P = 0.05
Short pods (10 cm or less) suitable for freezing or canning; freezing stage SL (seed length) 80; canning SL 90
Intermediate extra-fine pods (10 - 13 cm length; 6.5 - 8 mm width). Maturity judged by pod width, NOT by seed length
Intermediate pods (10 - 13 cm length; < 9.5 mm width) for freezing whole or cutting; freezing stage SL 90; canning SL 110
Intermediate pods (10 - 13 cm length) suitable for cutting (or slicing); freezing stage SL 90; canning SL 110
Long pods (> 13 cm length) suitable for cutting or slicing; freezing stage SL 100; canning SL 120

GREEN BEAN VARIETY STUDIES. Summary of agronomic data - Screening Variety Trial - 1991
Varieties placed in order of maturity within each group. Standard varieties underlined. All varieties sown on 20th June
Results are means of two replicates. Target population 45 plants per m^2. Row width 25 cm

Variety	Source	Seeds /kg	At Practical Freezing Stage: Maturity (± days) relative to Groffy	At Practical Freezing Stage: Yield % of Groffy	At Practical Canning Stage: Maturity (± days) relative to Groffy	At Practical Canning Stage: Yield % of Groffy	#Plant habit	No. pods touching soil 1=most 5=none	Pod Characteristics: External colour raw	Shape 1=v.curved 5=straight F	Shape C	Average length cm F	Average length cm C	Section 1=flat 5=round F	Section C	Pod width mm F	Pod width mm C
Short (fine)																	
Lasso	PV	6508	0	65⁻	0	82	5	4	M	4.8	4.8	8.8	9.2	4.6	4.8	8.0	8.1
Intermediate (extra fine/very fine)																	
WAV 4000	vW	6667	0	57⁻	- 1	73⁻	4	4	M/P	3.9	4.0	9.7	10.4	4.2	4.5	6.8	6.9
WAV 965	vW	5882	+ 1	60⁻	0	73⁻	4	4.5	M	4.1	4.4	9.1	9.4	4.6	4.6	6.8	6.9
WAV 6000	vW	6579	+ 2	86⁻	+ 1	88	4.5	4.5	M/D	4.1	4.1	10.7	10.9	4.0	4.2	6.8	6.9
Intermediate (whole)																	
MIV 15	Vil	5207	- 3	74⁻	- 4	77⁻	4	2	M	4.0	4.1	11.0	11.0	4.6	4.8	8.5	9.2
NAB	Conf	4600	- 1	84⁻	- 1	93	5	4.8	M/D	4.8	4.7	10.0	10.2	4.6	4.6	8.9	9.2
Nerina	RS	5453	0	78⁻	- 1	93	5	4	M	4.2	4.2	11.2	11.6	4.6	4.7	8.4	9.0
NIZ 029	Ni/Zw	5235	+ 1	76⁻	+ 1	85	4	2	M	4.1	4.0	9.8	10.0	4.7	4.6	8.0	8.2
Intermediate																	
PV 528	PV	3342	- 1	87⁻	- 1	92	5	3	M/D	4.2	4.2	11.4	12.0	4.6	5.0	10.0	10.5
Groffy	Nun	3992	0 (24/8)	100 (10.1t/ha)	0 (28/8)	100 (10.6t/ha)	5	5	M/P	4.8	4.7	11.1	11.3	5.0	5.0	10.3	10.8
NIZ 028	Ni/Zw	4543	0	99	0	99	4.5	4	M	4.7	4.6	10.0	10.3	4.9	5.0	9.7	10.1
Long podded																	
WAV 9017	vW	5464	+ 5	80⁻	+ 5	99	5	4.5	M/D	4.6	4.2	13.0	13.6	4.6	4.6	8.4	8.6
Significance @ P = 0.05				SD		SD						SD	SD			SD	SD
LSD @ P = 0.05				9.96		20.1						0.52	0.57			0.40	0.40
CV %				5.7		10.4						2.3	2.7			2.4	2.3

#Plant habit 5 = vigorous/erect/good pod distribution; 1 = short/lax/pods tangled/above leaf canopy
P = Pale; M = Medium; D = Dark. ⁻ Significantly less than Groffy @ P = 0.05
Short pods (10 cm or less) suitable for freezing or canning; freezing stage SL (seed length) 80; canning SL 90
Intermediate extra fine pods (10 - 13 cm length; 6.5 - 8 mm width). Maturity judged by pod width, NOT by seed length
Intermediate pods (10 - 13 cm length; < 9.5 mm width) for freezing whole or cutting; freezing stage SL 90; canning SL 110
Intermediate pods (10 - 13 cm length) suitable for cutting (or slicing); freezing stage SL 90; canning SL 110
Long pods (> 13 cm length) suitable for cutting or slicing; freezing stage SL 100; canning SL 120

11/1991

GREEN BEAN VARIETY STUDIES. Summary of machine harvesting data - Main and Preliminary Trial 1991
Percentage by weight of "T" stalks

Main Trial Variety	% T Stalks F
Nassau	19.5
Roma II	22.5+
Flevoro	29.5+
Lasso	30.5+
Nerina	30.5+
Groffy	11.5
Maxima (RO 34)	30.0+
Ventura (HS 200)	12.75
Novores	9.75
Modus	24.75+
Significance @ P = 0.05	SD
LSD @ P = 0.05	9.80
CV %	19.6

Preliminary Trial Variety	% T Stalks F	% T Stalks C
Lasso	19.0+	27.0+
Sirio	11.5	13.8
Boreal#	26.8+	32.0+
Masai	11.5	15.0
Label	21.8+	23.5+
Niki	24.8+	25.2+
Larissa	14.5	16.5
Monica	25.0+	28.5+
Cantare	21.5+	25.8+
Nerina	24.5+	30.0+
HS 537	14.0	27.25+
RS 1368	19.0+	16.8
Groffy	9.0	11.5
Fesca	16.0	20.5+
Significance @ P = 0.05	SD	SD
LSD @ P = 0.05	7.58	6.28
CV %	19.0	13.0

Several plants pulled up at F and at C stage
+ Significantly higher percentage than Groffy @ P = 0.05
% broken and damaged beans were not assessed and are related to operation of the machine/machine settings

12/1991

BROAD BEANS

Seven new broad bean varieties with a range of seed sizes were entered for trial. Yields were compared with Medes (standard seed size) and Talia was included for comparison with small seeded varieties.

BROAD BEAN TRIAL, THORNHAUGH - 1991

Seed of all varieties was treated with fungicide to control "damping off" diseases. The trial was sown into a moist seedbed on 10th April. May was a dry month, but above average rainfall in June resulted in good growth and plant height was greater than in 1990. During hot dry weather in June and July the broad beans showed signs of drought stress. Talia and Danko were the shortest strawed varieties.

There was no infection with chocolate spot *(Botrytis fabae)*. A little downy mildew *(Peronospora viciae)* was observed but this did not develop.

Harvesting began on 22nd July. *Danko* and *NIZ 89245* were the earliest maturing varieties, 2 days earlier than Medes. Harvest ended on 31st July with *NUN 9563* the latest variety to mature, 3 days after Medes.

Yield differences at canning stage were not significant.

NUN 9563 outyielded *Medes* at quick-freezing and canning stage and beans were slightly smaller than Medes.

Foxton, *No. 38* and *No. 24* beans were similar size, smaller than Medes and No. 38 was the lowest yielding.

Talia the small seeded standard performed well, giving similar yields to Medes this season.

Small seeded *Danko* outyielded Medes at quick-freezing stage, and beans were a little larger than Talia. *NIZ 89245* gave similar yields to Medes, produce was a little smaller than Talia but more rounded and rather uneven, but would be suitable for a quick-frozen mixed vegetable pack. Produce from *No. 680* was similar to Talia and not as uniform.

BROAD BEAN VARIETY STUDIES. Summary of agronomic data - Variety Trial, Thornhaugh - 1991
Varieties placed in order of maturity. Standard variety underlined. All varieties sown on 10th April
Results are means of two replicates. Target population 18 plants/m^2. Row width 30 cm

Variety	Source	Seeds /kg	At Practical Freezing Stage: Maturity (± days) relative to Medes#	At Practical Freezing Stage: Yield as % of Medes	Mean length 10 beans mm: F	Mean length 10 beans mm: C	At Practical Canning Stage: Maturity (± days) relative to Medes#	At Practical Canning Stage: Yield as % of Medes	Plant height cm
NIZ 89245	Ni/Zw	1656	- 2	100	169	177	- 3	93	80
Danko	Nun	1344	- 2	112+	183	189	- 2	102	76
No. 680	HS	1233	- 1	85-	181	185	- 2	102	78
Foxton	Nun	1242	- 1	91	201	206	0	98	81
Medes	Ni/Zw	1068	0 (24/7)	100 (4.4t/ha)	227	235	0 (29/7)	100 (5.2t/ha)	99
No. 38	HS	1227	+ 1	66-	208	208	0	89	87
Talia	Nun	1580	+ 1	96	180	184	+ 1	98	75
No. 24	HS	1259	+ 1	97	211	214	+ 1	106	100
Nun 9563	Nun	1310	+ 3	112+	210	209	+ 2	116	96
Significance @ P = 0.05				SD	SD	SD		NSD	
LSD @ P = 0.05				9.24	15.4	11.7		-	
CV %				4.2	3.4	2.5		10.5	

Maturity of Medes is normally 1 day earlier than Threefold White
+ Significantly greater than Medes @ P = 0.05; - Significantly less than Medes @ P = 0.05
Practical Freezing Stage - TR 110 - 140 for a 140 g sample
Practical Canning Stage - TR 115 - 140 for a 56 g sample

FIELD BEANS *(VICIA FABA)*

The trials programme included Recommended List Trials of winter and spring field beans at Thornhaugh as part of the National NIAB/PGRO series funded by PGRO pulse levy. There was also a screening trial of mainly coded new material from breeders. Many new white flowered spring beans and some winter beans were evaluated.

The winter was mild, as in previous years and no assessments of cold tolerance of winter bean varieties could be made. May, July and August were very dry months but rainfall during June was a little above average. Field beans were taller and more vigorous than in 1989 and 1990, some lodging occurred and varietal comparisons of standing ability were possible. Incidences of disease were very low and yields of both winter and spring beans were better than in 1990.

WINTER FIELD BEAN VARIETIES - RECOMMENDED LIST TRIAL, THORNHAUGH - 1990/1991 (NIAB/PGRO)

Varieties of winter sown beans at Recommended List Stage of testing were evaluated at Thornhaugh on a clay loam soil as part of the National RL series. Only one new variety Glacier was evaluated. The control varieties were Bourdon, Boxer and Banner.

The trial was sown on 5th November, aiming at final target populations of 20 plants/m^2. Since the winter was mild, there were no plant losses, so the actual final populations were 22-3 plants/m^2.

Punch and Banner were the shortest strawed varieties. Banner suffered from severe lodging, and the percentage of lodging for Glacier was similar to Punch.

Banner was the earliest variety to mature, harvested on 27th August. Glacier and Boxer matured last.

Bourdon and Punch were the highest yielding varieties. Glacier yielded significantly less than the mean of control varieties (although yields were similar to Banner). Glacier is white flowered and the produce, which is tannin-free, is more attractive to the compounder. However the grower would need a higher price to compensate for lower yields.

SPRING FIELD BEAN VARIETIES - RECOMMENDED LIST TRIAL, THORNHAUGH - 1991 (NIAB/PGRO)

Varieties of spring sown beans at Recommended List stage of testing were evaluated at Thornhaugh on a clay loam soil as part of the National RL series with six other sites.

Thirteen varieties including white flowered and short strawed types were evaluated in Recommended List Trial and yields were compared with standard varieties Alfred, Troy, Corton and Victor. Short strawed varieties Caspar, Pistache and Toret were sown in blocks separated from taller varieties by discard areas.

Varieties were sown on 18th March in eight rows, 15 cm row width. The target population of 40 plants/m^2 was achieved.

Rainfall was near the seasonal average for April and above average for June during the flowering period. In May, July and August rainfall was very low and the beans appeared to suffer drought stress during pod fill stage. There were virtually no disease infections, but there was an aphid infestation after pods had set.

Plants were taller than last year but no variety lodged, although by harvest Gobo, Frinebo, Corton and Bertos were leaning to a small extent. The shortest strawed varieties were Toret, Caspar, Pistache and Octopus, and Albatross was also short strawed. The tallest varieties were Frinebo, Gobo, Condor and Corton.

Troy, harvested on 13th August, was the earliest maturing variety, closely followed by Victor, Caspar, Cardinal, Pistache and Titan. Gobo, Frinebo and Bertos matured much later.

There were few significant yield differences in this trial. The control variety Troy gave very low yields, and it was noted earlier in the season that pod set was poor. No variety yielded significantly higher than the mean of the control varieties. Bertos gave the highest yields, and Victor, Gobo and Alfred also performed well. The white flowered varieties Toret and Caspar yielded similarly, they were not significantly lower yielding than the controls. Barker yielded similarly to the standard pigeon feed variety Maris Bead. Yields for Barker and white flowered Octopus were significantly lower than the controls. New varieties Condor and Cardinal yielded similarly to Corton.

Barker, a potential variety for pigeon feed was the smallest seeded variety, smaller than Maris Bead. Pistache, Victor, Albatross and Toret were large seeded.

SPRING FIELD BEAN VARIETIES - SCREENING TRIAL, THORNHAUGH - 1991

Fourteen varieties of field beans were compared with controls Troy and Alfred in terms of yield and field characteristics. The beans were sown on 12th March in good conditions and emergence was even. Rainfall was near the seasonal average for April and wetter than average in June during the flowering period. In May, July and August rainfall was very low and during pod fill stage the beans appeared to suffer drought stress. There were virtually no disease infections and few aphid on this trial.

The shortest strawed variety was OS223, and no variety lodged.

Varieties Conf 12 and 13 were very early maturing, as early as Troy, Conf 415 and 411 were also early.

Only one variety Conf 415 significantly outyielded the control varieties Troy and Alfred. 6-9023 and Conf 310 also performed well. None of the other varieties outyielded Alfred, and several yielded significantly lower than the controls.

Conf 412 was very large seeded, Conf 310 and 415 were also large seeded and they could be difficult to sow with conventional cereal drills.

WHITE FLOWERED BEANS FOR THE COMPOUNDER - WINTER FIELD BEANS, THORNHAUGH - 1990/1991

Four white flowered varieties were compared with coloured flowered standards Punch and Bourdon for yield and field characteristics. White flowered varieties with tannin-free produce are more acceptable for compounding, particularly for pigs and poultry.

The trial was sown on 5th November 1990 at a final target population of 20 plants/m^2 into a good seedbed. The winter was mild and there were few plant losses in this trial, thus winter hardiness of the varieties could not be assessed.

Winter beans were taller, more vigorous and lodging was greater than last season. There were only slight chocolate spot infections and no downy mildew or bean rust. Glacier and Bourdon were the tallest varieties and Bourdon suffered the highest percentage of lodging. Punch and Glacier lodged to a lesser extent. 438/2 with the shortest straw and 532/2 had very good standing ability and hence good harvestability.

Harvest which began on 25th August was later than in 1990. The earliest maturing variety was 438/2, harvested two days before Bourdon and 2103 was also early. Yields of Glacier and 438/2 were similar to the coloured flowered controls, 432/2 and 2103 yielded significantly less.

In this trial the white flowered varieties Glacier and 438/2 performed well. Variety 438/2 had shorter plants, better standing ability and was earlier than Glacier and looked very promising.

WHITE FLOWERED BEANS FOR THE COMPOUNDER - SPRING FIELD BEANS, THORNHAUGH - 1991

The aim of the trial series, begun in 1986, is to assess varieties of white flowered tannin-free field beans for yield, maturity, harvestability and other agronomic characters and also to provide compounders with samples of produce from the trial so that quality for animal feed could be determined by analysis and feeding studies. White flowered tannin-free varieties are more acceptable for compounding for pig and possibly poultry diets, than coloured flowered varieties. White flowered spring sown field bean varieties (19) including breeders coded material, were compared with standard coloured flowered control varieties Troy, Alfred and Corton for yield and field characteristics.

The trial was sown on 18th March on a sandy clay loam soil (OM 2.3%) at Thornhaugh. Conf 4 appeared to be slightly sensitive to herbicide Opogard.

Bean growth was much more vigorous and yields generally higher than in the previous two years. There was little chocolate spot, downy mildew or rust infection in varieties in this trial. None of the white flowered varieties were longer strawed than Corton, Conf 2 and 417/B/2 were the tallest and these varieties were also leaning by harvest. No variety lodged.

The earliest variety was 6-9025, maturing on 19th August a day before Troy. Conf 4, Octopus, Conf 7 and Conf 11 were also early maturing. 417/B/2 and Conf 5 matured later than Corton.

Control variety Troy gave low yields and may have been affected by cold weather at flowering. Conf 10 and 6-9022 yielded significantly better than the mean of the controls and all other varieties including Alfred; Conf 90907, Conf 8 and 417/B/2 also outyielded the controls. Toret and Cresta also performed well and yields were very similar to Alfred. Only a few varieties (5) gave significantly lower yields than the mean of the controls. Varieties Conf 5 and Conf 300 were very large seeded.

Samples were sent to interested compounders for analysis and feeding studies.

There were some extremely promising varieties in this trial with yield potential higher than established coloured flowered varieties. At the moment compounders do not generally pay a premium for white flowered varieties.

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - Winter Field Bean Recommended List Trial - 1990/1991
Control varieties underlined. All varieties sown on 5th November 1990 at a target population of 20 plants/m^2
Results are means of four replicates. Yields (@ 15% MC) are given as a % of control varieties Bourdon, Boxer and Banner

Variety	Source	Plants/m^2 emerged	Plants/m^2 final	Seeds/kg	Maturity (± days) relative to Banner	Yield % of controls @ 15% MC	Straw length (cm)	% Leaning on 24/8	% Lodging on 24/8	Thousand seed weight (g)
Bourdon	PBI	22	22	1511	+ 2	105+	186	58	42	621
Punch	PBI	27	23	1488	+ 3	105+	174	88	15	617
Boxer	PBI	25	22	1652	+ 5	98	183	58	20	678
Banner	PBI	24	23	1701	0(27/8)	97	173	30	70	627
Glacier w	PBI	26	22	1843	+ 5	94-	183	86	14	660
Mean yield of controls						4.263 t/ha				
Significance @ P = 0.05						SD				
LSD @ P = 0.05						2.16				
CV %						3.1				

- Significantly lower than the mean yield of control varieties; + Significantly higher than the mean yield of control varieties

w = white flowered

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - Spring Field Bean Recommended List Trial - 1991
Control varieties underlined. All varieties sown on 18th March at a target population of 40 plants/m^2
Results are means of three replicates. Yields (@ 15% MC) are given as % of control varieties Alfred, Troy, Corton, and Victor

Variety	Source	Seeds/ kg	Maturity (± days) relative to Troy	Yield % of controls @ 15% MC	Straw length (cm)	Leaning % @ harvest	Ease of harvest 9=easy 1=difficult	Thousand seed weight (g)
Bertos	VEB	2016	+20	113	126	4	9	545
Victor	SI	1639	+ 1	109	113	0	9	598
Gobo	Sh	1721	+16	109	135	7	9	482
Alfred	SI	1923	+ 8	109	118	0	9	509
Toret w	Ni	1511	+ 9	105	105	0	9	557
Caspar w	SI	1712	+ 1	104	105	0	9	501
Cardinal	Twy	2660	+ 1	104	121	0	9	420
Frinebo	Sh	1898	+17	104	138	5	9	529
Corton	Sem	2169	+10	103	130	3	9	505
Condor	Lem	1862	+10	103	134	2	9	442
Pistache	ICI	1577	+ 2	99	104	0	9	645
Titan (6/9006)	Mar	2577	+ 2	99	126	0	9	467
Albatross w	Twy	1946	+14	89	104	0	9	591
Maris Bead	PBI	2545	+14	86	126	1	9	387
Barker	Bar	3344	+ 4	85-	123	0	9	347
Octopus w	ICI	1613	+ 1	82-	110	0	9	479
Troy	Twy	2375	0(13/8)	80-	121	0	9	430
Mean yield of controls t/ha				4.01				
Significance @ P = 0.05				SD				
LSD @ P = 0.05				18.2				
CV %				9.8				

- Significantly lower than the mean yield of control varieties

w = white flowered

19/1991

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - Spring Field Bean Screening Trial - 1991
Control varieties underlined. All varieties sown on 12th March at a target population of 40 plants/m^2
Results are means of two replicates. Yields are given as % of control varieties Troy and Alfred

Variety	Source	Seeds/ kg	Maturity (± days) relative to Troy	Yield % of controls @ 15% MC	Straw length cm	Lodging 9=erect 1=lodged	Ease of harvest 9=easy 1=difficult	Thousand seed weight g
Conf 415	Conf	1238	+ 2	115.8+	136	9	9	737
6-9023	Mar	1490	+15	105.0	142	9	9	644
Conf 310	Conf	1737	+13	104.5	135	9	9	776
Alfred	SI	1923	+ 3	103.6	132	9	9	565
Conf 12	Conf	1665	0	100.4	123	9	9	680
6-9019	Mar	1965	+ 3	97.7	130	9	9	478
Troy	Wh	2375	0(18/8)	96.4	122	9	9	538
Jupiter (6-9018)	Mar	2155	+ 5	95.9	131	9	9	488
Conf 13	Conf	1513	0	94.8	126	9	9	627
OS223	Twy	1600	+ 4	89.7	106	9	9	544
Conf 412	Conf	1265	+ 5	88.9	130	9	9	909
Conf 315	Conf	1739	+ 8	88.6	127	9	9	613
Conf 413	Conf	1767	+ 5	85.4-	136	9	9	638
Conf 414	Conf	1805	+ 6	81.9-	129	9	9	633
Conf 411	Conf	1852	+ 2	78.2-	121	9	9	504
Mean yield of controls				5.21 t/ha				
Significance @ P=0.05				SD				
LSD @ P=0.05				12.69				
CV %				6.4				

+ Significantly higher than the mean yield of control varieties; - Significantly lower than the mean yield of control varieties

20/1991

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - White Flowered Beans for the Compounder - Winter Field Bean Trial - 1990/1991

Control varieties underlined. All varieties sown on 5th November 1990 at a target population of 20 plants/m^2

Results are means of three replicates. Yields (@ 15% MC) are given as % of control coloured flowered varieties Bourdon and Punch

Variety		Source	Plants/m^2 emerged	Plants/m^2 final	Seeds/kg	Maturity (± days) relative to Bourdon	Yield % of controls @ 15% MC	Straw length (cm)	% Lodging on 24/8	% Leaning on 24/8	Thousand seed weight (g)
Punch		PBI	21	22	1544	+ 3	106	168	10	53	589
Bourdon		PBI	23	22	1675	0(27/8)	94	174	37	63	591
Glacier	w	PBI	23	22	1926	+ 6	101	178	13	87	663
438/2	w	PBI	19	20	1824	- 2	91	167	0	10	653
532/2	w	PBI	25	21	1774	+ 4	86-	173	0	10	603
2103	w	PBI	21	23	2095	0	85-	176	0	77	538
Mean yield of controls							5.93 t/ha				
Significance @ P = 0.05							SD				
LSD @ P = 0.05							10.30				
CV %							6.0				

- Significantly lower than the mean yield of control varieties

w = white flowered

FIELD BEAN VARIETY STUDIES. Summary of agronomic data - White Flowered Beans for the Compounder - Spring Field Bean Trial - 1991

Control varieties underlined. All varieties sown on 18th March at a target population of 40 plants/m^2

Results are means of three replicates. Yields are given as a % of coloured flowered control varieties Troy, Alfred and Corton

Variety		Source	Seeds/ kg	Maturity (± days) relative to Troy	Yield % of controls @ 15% MC	Straw length (cm)	% Leaning (% Brackling)	Thousand seed weight (g)	RL/NL status
Corton	c	Sem	2169	+13	107	163	30	462	RL
Alfred	c	SI	1923	+ 7	106	144	0	487	RL
Troy	c	Wh	2375	0(20/8)	88	133	0	428	RL
Conf 10		Conf	1722	+ 7	119^{+}	140	0	455	
6-9022		Mar	1299	+ 9	119^{+}	135	2(8)	681	
Ceb 90907		SI	1793	+ 7	111^{+}	131	0	483	
Conf 8		Conf	1512	+13	108^{+}	129	0	659	
417/B/2		PBI	2247	+15	108^{+}	147	12	554	
Toret		Ni	1511	+ 8	106	126	(5)	537	(P)RL
Cresta (702-PC/LN)		PBI	1942	+ 7	105	131	(3)	604	NL2
Conf 11		Conf	1617	+ 3	103	133	0	475	
Conf 6		Conf	1753	+ 8	101	134	0	461	
Conf 2		Conf	2381	+ 9	98	150	10	445	
6-9008		Mar	2494	+11	98	144	4	363	
Conf 1		Conf	2096	+ 9	96	135	0	471	
Albatross		Twy	1946	+11	95	138	0	544	RL
Conf 7		Conf	1654	+ 2	94	140	0	481	
Conf 5		Conf	769	+14	87^{-}	132	0	1208	
Octopus		ICI	1613	+ 1	85^{-}	133	1	472	RL1
Conf 3		Conf	2110	+ 8	79^{-}	127	0	475	
6-9025		Mar	1678	- 1	76^{-}	130	0	531	
Conf 4		Conf	2364	+ 2	75^{-}	129	0	416	

Mean yield of controls 5.62 t/ha

	SD
Significance @ P = 0.05	
LSD @ P = 0.05	7.22
CV %	4.4

$^{+}$ Significantly higher than the mean yield of control varieties; $^{-}$ Significantly lower than the mean yield of control varieties

c = coloured flowered

APPENDIX I

KEY TO SOURCE OF VARIETIES

CODE	NAME & ADDRESS	COUNTRY
As	Asgrow Seed Company 9634-190-31 7000 Portage Road Kalamazoo MI 49001	USA
Bar	Barenbrug UK Limited P.O. Box 2 Bury St. Edmunds Suffolk IP30 9NW	UK
Ceb	Cebeco Zaden BV 31 Blaak Postbus 182 3000 AD Rotterdam	Holland
Conf	Confidential	
D	Dalgety Agriculture Limited, Dalgety House, Works Lane Setchey Kings Lynn Norfolk PE33 0AU	UK
HS	Holland Select BV P.O. Box 27 1619 ZG Andijk	Holland
ICI	ICI Seeds UK Limited Marsh Lane Boston Lincolnshire PE21 7RR	UK
Lem	Hans-Georg Lembke KG Norddeutsche Pflanzenzucht D-2331 Hohenlieth Post Holtsee U Eckernforde	Germany
Mar	Maribo (UK) Ltd. Potterhanworth Lincoln LN4 2DY	UK
Ni	Nickerson Seeds Limited Rothwell Lincoln LN7 6DT	UK
Ni/Zw	Nickerson/Zwaan BV Rothwell Lincoln LN7 6DT	UK
N&S	Nutting & Sons Limited 1500 Melton Queniborough Leicester LE7 8FN	UK

Nun	Nunhems Zaden BV Postbus 4005 6080 AA Haelen	Holland
PBI	Plant Breeding International Cambridge Maris Lane Trumpington Cambridge CB2 2LQ	UK
PV	Pop Vriend BV P.O. Box 5 1619 ZG Andijk	Holland
Rog	Rogers Brothers Seed Co. International Group P.O. Box 4727 Boise, ID 83711-0727	USA
RS	Royal Sluis Postbus 22 1600 AA Enkhuizen	Holland
Sem	Semundo Limited Unit 55 Clifton Road Cambridge CB1 4FR	UK
S&G	Sluis & Groot BV P.O. Box 13 Enkhuizen	Holland
Sh	Sharpes International Seeds Ltd. Boston Road Sleaford Lincolnshire NG34 7HA	UK
SI	Seed Innovations Limited 1 Paradise Road Downham Market Norfolk PE38 9HS	UK
Twy	Twyford Seeds Limited Scotts Farm, Kings Sutton Banbury Oxfordshire OX17 3QW	UK
VEB	VEB Saat-Und Pflanzgut Noosdorfstrasse 7-9 1193 Berlin-Treptow	Germany
Vil	Vilmorin SA La Menitre 49250 Beaufort-en-Vallee	France
vW	van Waveren Pflanzenzucht GmbH D-3405 Rosdorf Uber Gottingen	Germany
Wh	Wherry & Sons Limited South Street Bourne Lincolnshire PE10 9LU	UK